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EXAMINER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JIAN J. CHEN,
ROBERT G. VELTROP, and
THOMAS E. WICKER

Appeal 2008-3576
Application 10/647,347
Technology Center 1700

Decided: September 19, 2008

Before TERRY J. OWENS, HOWARD B. BLANKENSHIP, and
MAHSHID D. SAADAT, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

The Appellants appeal from a rejection of claims 32-41, which are all of the pending claims.

THE INVENTION

The Appellants claim methods for manufacturing inductive plasma processors and controlling their plasma flux distribution. Claim 32 is illustrative:

32. A method of manufacturing many different inductive plasma processors of the same type, each of the processors including a plasma excitation coil having plural electrically connected windings, each of the windings having a pair of excitation terminals, the windings of the coil of each processor being adapted to be driven by an excitation source arrangement so that different currents simultaneously flow through the pair of excitation terminals of each winding, the plural windings of each coil of each processor being arranged so an exterior winding of the coil is about an interior winding of the coil, the exterior winding and the interior winding being about an axis of the coil, the different processors of the same type having differing electric field and plasma density distributions from processor to processor, the method comprising for each of the inductive plasma processors:

moving the position of the exterior and interior windings relative to each other and the axis so the plasma density incident on a workpiece in a chamber of the processor has a predetermined desired relationship until tests conducted on each processor indicate optimum uniform plasma distribution is achieved in each processor.

THE REFERENCES

Yoshida	US 5,690,781	Nov. 25, 1997
Ishii	US 5,795,429	Aug. 18, 1998
Savas	US 5,983,828	Nov. 16, 1999
Chen	US 6,164,241	Dec. 26, 2000
Lee	US 6,288,493 B1	Sep. 11, 2001
Ni	WO 00/58993	Oct. 5, 2000

THE REJECTIONS

Claims 32-41 stand rejected under 35 U.S.C. § 103 over: 1) Ishii in view of Yoshida and Savas, 2) Ishii in view of Ni and Savas, 3) Chen in view of Yoshida and Savas, 4) Chen in view of Ni and Savas, 5) Lee in view of Yoshida and Savas, and 6) Lee in view of Ni and Savas.

OPINION

We reverse the rejections over Ishii in view of Yoshida and Savas, Chen in view of Yoshida and Savas, and Lee in view of Yoshida and Savas, and affirm the rejections over Ishii in view of Ni and Savas, Chen in view of Ni and Savas, and Lee in view of Ni and Savas.

Rejections over Ishii in view of Yoshida and Savas,
Chen in view of Yoshida and Savas, and
Lee in view of Yoshida and Savas

The Appellants' independent claims require "moving the position of the exterior and interior windings relative to each other and the axis" (claim 32), "turning the exterior and interior windings of the coil relative to each other about an axis" (claim 36), and "moving the exterior and interior windings of the coil relative to each" (claim 39). For those claim requirements the Examiner relies upon Yoshida's Figures 6A and 6B and their descriptions (Ans. 5, 9, 13, 17-19).

Yoshida discloses, regarding Figures 6A and 6B, that "the spiral coil **2** is made movable in the direction parallel to the main planar surface of the dielectric plate, or in effect the radial direction of the reaction chamber **1** by a motor **23** and a control mechanism thereof" (col. 5, ll. 9-13).

The Examiner argues that Yoshida shows movement of windings relative to each other (Ans. 17-19).

Yoshida discloses, in Figures 6A, 6B and elsewhere, a coil having a single winding. Hence, there is no movement of windings relative to each other. Yoshida moves the single winding parallel to the main planar surface of the dielectric plate window (4) (col. 5, ll. 9-11).

Thus, the Examiner has not established a prima facie case of obviousness of the Appellants' claimed invention over Ishii in view of Yoshida and Savas, Chen in view of Yoshida and Savas, and Lee in view of Yoshida and Savas.

Rejections over Ishii in view of Ni and Savas,
Chen in view of Ni and Savas, and
Lee in view of Ni and Savas

The Appellants' arguments regarding independent claims 32, 36 and 39 are essentially the same, and there is no substantive argument regarding the separate patentability claims 33, 35, 38 and 41. Hence, we address those claims together, and we address a separate argument directed toward Ishii regarding claims 34, 37 and 40. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2007).

Ishii (Figs. 8-10; col. 9, l. 51 – col. 10, l. 58), Chen (Fig. 6; col. 9, l. 16 – col. 10, l. 15) and Lee (Figs. 3A, 3B, 5; col. 3, ll. 34-56; col. 4, ll. 34-41; col. 5, ll. 2-6) disclose plasma processors comprising plasma excitation coils having plural windings.

Ni discloses a plasma processor comprising a coil (216) including four turns (221-224) that are concentric about the coil's center axis (225) (p. 15, ll. 26-27). "Electrical insulating blocks 241-246, bonded to the top edges of the straps forming turns 221-224, rigidly connect adjacent pairs of the turns together" (p. 16, ll. 4-6). Blocks 244, 245 and 246 are attached, respectively, to lead screws 211, 212 and 213 which are attached, respectively, to motors 201, 202 and 203 (p. 16, ll. 15-23; Fig. 2).

[M]otors 201-203 can drive outer turns 223 and 224 so these outer turns are tilted so that, e.g., (1) the parts of outer turns 223 and 224 connected to block 244 are closer to window 46 than the parts of these turns that are connected to block 245, and (2) the parts of turns 223 and 224 connected to block 246 are farther from window 48 [sic, 46] than the parts of these outer turns connected to block 245 [p. 16, ll. 26-32].

The tilting enables the RF field coupling between different portions of coil 216 and the plasma (50) to be controlled such that the plasma flux density is either uniform or varied on different parts of the workpiece (p. 4, ll. 21-28; p. 17, ll. 1-9).

The Appellants argue that Ishii, Chen, Lee and Ni are concerned with the structure of a single plasma processor, not with making many plasma processors of the same type (Br. 30, 31, 41, 63-64).

Initially, we note that the Appellants' original disclosure lacks literal written descriptive support for "many" processors. The Appellants' original Specification states that the invention is "a method of making an inductive plasma processor" (Spec. 1:11) and, with respect to optimization, uses the expression "different processors of the same type" (Spec. 32:22-23). Regardless, the disclosures of plasma processors by Ishii, Chen, Lee and Ni would have led one of ordinary skill in the art, through no more than ordinary creativity, to make many processors so that products could be made in greater quantities and in multiple locations. *See KSR Int'l. Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (In making the obviousness determination one "can take account of the inferences and creative steps that a person of ordinary skill in the art would employ").

The Appellants argue, regarding claims 34, 37 and 40, that Ishii's exterior and interior windings 24A and 24B are not connected in parallel because they are connected to different RF power sources (Br. 39).

That argument is not convincing in view of Ishii's disclosure that "it is possible to use commonly a single high frequency power supply in place of the first and second high frequency power supplies **28A** and **28B** by providing a power distributing circuit between the high frequency power supply and the antenna **24A** and between the high frequency power supply and the other antenna **24B**" (col. 10, ll. 23-27).

The Appellants argue (Br. 53-54):

While Chen indicates it is possible to turn coil 1 relative to coil 2, to provide a configuration where the small openings of the split rings of the coils are aligned, Chen et al. indicates such turning is not performed until tests conducted on each processor indicate optimum uniform plasma distribution is achieved in each processor. Instead, column 9, lines 37-40 indicates such turning is undesirable because such a configuration results in a lower power coupling to the plasma.

Chen discloses that "[i]t is evident from FIG. 6 that the small openings of the split rings of Coils **1** and **2** are misaligned. While it is possible to provide a configuration where the openings are aligned, one skilled in the art will appreciate that such a configuration would result in a lower power coupling to the plasma in the location of the openings" (col. 9, ll. 35-40). The Appellants do not point out where Chen discloses that the turning does not take place until optimum uniform plasma distribution is achieved, and such a disclosure is not apparent. As for the Appellants' argument that the aligning is undesirable, Chen's disclosure is that the aligning results in a lower power coupling to the plasma in the location of

the openings (col. 9, ll. 37-40). Chen does not disclose that the lower power coupling at the openings renders the device unsuitable in any way. Hence, Chen would not have discouraged one of ordinary skill in the art from turning the coils such that their openings are aligned.

The Appellants argue that “the Ni et al. coil is on a preprogrammed basis in response to recipes stored in memory, rather than in response to testing” (Br. 29).

Ni discloses that “[m]emory 24 stores signals indicative of the desired position, relative to window 46, of the shaft of each motor for each recipe” (p. 10, ll. 8-10). The Appellants’ argument is not persuasive because it appears that testing is required by the user to determine the signals that are indicative of the desired shaft positions for each recipe.¹

The Appellants argue that Ni does not turn the turns relative to each other but, rather, merely translates them vertically relative to the processor window, and that Ni does not turn windings relative to each other (Reply Br. 6-7).

Ni’s coil has only one winding, and Ni tilts the outer turns of that winding to enable the RF field coupling between different portions of coil 216 and plasma 50 to be controlled such that the plasma flux density is either uniform or varied on different parts of the workpiece (p. 4, ll. 21-28; p. 16, ll. 26-32; p. 17, ll. 1-9). Ni’s disclosure that adjacent pairs of turns are rigidly connected by electrical insulating blocks 241-246 (p. 16, ll. 4-6)

¹ The Appellants’ claims do not require that the testing is performed when the plasma processors are made but, rather, encompass testing by each processor’s user to determine the optimum uniform plasma distribution for that user’s process.

indicates that tilting the outer turns also tilts the inner turns and, therefore, tilts the winding. Ni would have led one of ordinary skill in the art, through no more than ordinary creativity, to similarly tilt external turns of the Ishii (Fig. 9), Chen (Fig. 6) and Lee (Fig. 3B)² coils having external and internal windings, to enable each winding to contribute to obtaining the desired control of plasma flux density. Such tilting of winding turns to obtain the desired plasma flux density would tilt the turns such that the external and internal windings are moved (claims 32 and 39) or turned (claim 36) relative to each other about the coil axis (e.g., from all turns of both windings being horizontal to the winding turns being tilted (turned) relative to the coil axis such that each winding's turns are in non-horizontal planes).

For the above reasons we are not persuaded of reversible error in the rejections of claims 32-41 over Ishii in view of Ni and Savas, Chen in view of Ni and Savas, and Lee in view of Ni and Savas.³

DECISION

The rejections under 35 U.S.C. § 103 of claims 32-41 over Ishii in view of Yoshida and Savas, Chen in view of Yoshida and Savas, and Lee in view of Yoshida and Savas are reversed. The rejections under 35 U.S.C. § 103 of claims 32-41 over Ishii in view of Ni and Savas, Chen in view of Ni and Savas, and Lee in view of Ni and Savas are affirmed.

² There is no dispute as to whether Lee's illustration of a coil having multiple windings, each with one turn (Fig. 3B), would have rendered *prima facie* obvious, to one of ordinary skill in the art, a coil having windings with multiple turns.

³ A discussion of Savas is not necessary to our decision.

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED

tf/ljs

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